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Comparative Analysis of Conventional Mortars and Instant Mortars (RAPI) Against Stone and Plastering Wall Pairs Judging from Quality, Cost, and Time

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ABSTRACT

The development of technology in construction has resulted in ready-made Mortar products is one product that is increasingly needed in the construction industry for several reasons such as material source, project location, quality accuracy, material efficiency, management and price factors. The larger the scale of the city and the more difficult to get quality materials at low prices and increasingly complex handling, it is enough to make an excuse in developing a more practical product with better quality assurance. The aim is to lead to ease in the process of work in the field while continuing to prioritize quality, but its utilization is still not maximized. This study tries to determine the neat instant mortar comparison with conventional mortar against the cost, quality, and time of the red brick and plastering wall pairs. The results showed that the compressive strength in 28 days the compressive strength of Mortar RM-115 with a compressive strength of 215.88 kg / cm2 which is larger and more measurable than Conventional Mortar with a value of 151.76 kg / cm2 whose implementation is sometimes incorrect. The time needed to complete the red brick wall pair work using Mortar RM-115 material is 14 days, while the time needed on the work of the red brick wall pair Conventional Mortar material is 15 days. So that the work of the red brick wall pair using the Mortar RM-115 material is more efficient 1 day and cleaner storage compared to using conventional Mortar material. The price of installing red brick walls with Mortar RM-115 materials in Bintaro Sector 7 housing is Rp. 36,858,425.99. While the price of installing red brick walls and plastering using conventional Mortar materials in Bintaro Sector 7 housing is Rp. 47,188,780.22. Work Installation of red brick walls and plaster using Mortar materials RM-115 is more expensive with a difference of Rp. 10,330,354.23.

Keywords: *Comparative Analysis of Conventional Mortar and Instant Mortar (RAPI) Against a Pair of Bricks and Plastering Walls Judging From Quality, Biaya, and Time.*

INTRODUCTION

Current technological developments have led to the era of globalization by emphasizing product quality and efficiency. Problems that are often encountered in the field and demands must be answered by developing innovations to produce a product that is more competitive, applicable and easy to apply in the field. Mortar as a binding material in the work of couples and plastering and other settlement work plays an important role because in addition to meeting technical requirements, it must also provide high decorative value. The function of mortar in wall pairs is as a binder between brick elements, eliminating the brick surface deviation, and channeling the load received by the wall components. While the function of mortar in plaster is leveling the surface, beautifying the building, preventing wasteful use of paint and protecting from the influence of weather.

With the increase in construction activities, especially buildings and housing needs to be balanced with the availability of adequate materials. The problems faced today are the increasingly limited sources of raw materials, the difficulty of transportation, limited land, the amount of material wasted, and the demands of product quality, especially in big cities. Therefore it is necessary to look for alternative solutions that are better in

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addressing the problem as an effort to develop technology while fulfilling quality assurance in line with global demands.

In this study not only aims to inform about the choice of wall materials but also the comparison of advantages and disadvantages including material properties, costs and implementation time between conventional and new materials.

The development of technology in construction has resulted in ready-made Mortar products is one product that is increasingly needed in the construction industry for several reasons such as material source, project location, quality accuracy, material efficiency, management and price factors. The larger the scale of the city and the more difficult to get quality materials at low prices and increasingly complex handling, it is enough to make an excuse in developing a more practical product with better quality assurance. Mortar Ready to Use (MSP) currently in use from PT. Rapi Hijau Perkasa PT. Duta Sarana Perkasa with RAPI Mortar Brand products that are used for various jobs such as residential buildings (towers and apartments), office buildings, education, industry, hotels, malls and others, where demands for quality and work efficiency are needed. Furthermore, if the current mortar product has developed sufficiently to meet the technical requirements and in accordance with the intended use, it needs further study and research so that it can answer the problem.

Of course, knowledge about this is needed, considering the addition of mortar strength is also associated with additional costs. Therefore it is necessary to conduct further research on the compressive strength of the couple walls against more variations in the composition of the mortar mixture, and the optimization of the use of mortar on the red brick pair walls. As the author is interested in taking the title of a comparative analysis of neat mortar with conventional mortar against the installation of brick and stucco walls in terms of quality, cost, and time.

The wall is a part of the building that functions as a weight bearing, giving weight throughout the building, as a silencer and radiation, separating the outside space from the inside, protecting against the weather, roofing, as a barrier, and retaining heat from the sun, and withstand wind the wind outside. The wall is a very important part of the building's role for a building construction. The walls form and protect the contents of the building both in terms of construction and artistic appearance of the building. (Fianli, 2011).

Batu Bata

Brick or red brick is an artificial stone made from clay or clay, dried in the sun for several days depending on weather conditions, then deposited, so that the course of the combustion fire can be evenly distributed to the outer pile layer.

The strength of a brick is greatly influenced by the composition of the raw materials making up the combustion temperature, the manufacturing process, and its porosity. Ideal brick size:

Length = 23-24 cm
Width = 11 - 11.5 cm
Thickness = 5-6 cm

With each allowable deviation for the size is a maximum length of 3%, a maximum width of 4% and a maximum thickness of 5%. (Frick, 1980).

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Mortar

Mortar or species, or mortar, according to Murdock, R. (1980) is a mixture composed of cement, sand, water, in a certain time will harden like rocks. In construction work, Mortar is used as a binding material for bricks, stones and concrete blocks. Mortar can function as a structural construction as well as non-structural construction. In the structural construction Mortar is used as a wall species and foundation, while for non-structural mortar construction is used as an outer wall coating. As a structural construction, Mortar is planned to withstand the compressive force (as a binder on a brick wall or foundation) as well as the glue between red bricks in making walls inside the house or outside the house, stone adhesive in foundation construction, or as a layer of plaster on brick wall surface, or the other. For this reason, it is necessary to know the compressive strength that can be held by the mortar both during the construction process and after construction is planned to be able to withstand all loads. Mortar ingredients can also be added to add ingredients to accelerate hardening or other purposes (Tjokrodimuljo, 1996).

Mortar strength is needed to deal with the forces on the wall or the work of couples who work in a direction parallel to the fiber pressing the mortar and has a minimum compressive strength equal to the compressive strength on the red brick.
According to SNI 03-6882-2002; 2-3 and ASTM C 270, mortar is classified into 4 types based on proportion of ingredients and property specifications, namely: M, S, N, and O, each type consists of fine aggregate (sand), water and cement.
Wall pairs receive compressive loads caused by influences from above, wind, or other side forces. In ASTM C 270 mortar classification based on compressive strength and designation are given in the table below.

Tabel 1. Mortar properties specification requirements

Mortar	Type	Strength on average 28 days min. (MPa)	Retention Water Min (%)	Until udara max (%)	Aggregate ratio (measurement of damp and loose conditions)
Cement couple	M	17,2	75	….. b)	2,25 - 3 times the amount volume is cement
	S	12,4	75	….. b)	
	N	5,2	75	….. b)	
	O	2,4	75	….. b)	

(Sumber:SNI 03-6882, 2002: 3)

Tabel 2. Klasifikasi Kuat Tekan Mortar & Penggunaannya

Stir Type	Power	Recommendations for Use
Type M	Mix with high compressive strength The minimum compressive strength is 175 kg/cm^2.	For reinforced brick walls, walls near the ground, foundation pairs, mix dirty water pipe pairs, mix retaining walls and mix for roads
Type N	Press firmly on medium Minimum pressure of 124 kg/cm^2.	Used without the use of type M, but high tensile strength and side force.
Type S	Mix well with medium press Pressure at minimum 52,5 kg/cm^2.	Used for open couples on the ground.

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Tpe O	Mix with low compressive strength The minimum compressive strength is 24,5 kg/cm^2.	Used for wall construction that does not withstand a weight of no more than 7 kg / cm^2 and is not severe weather disturbances.
Tipe K	Mix well with low pressure Minimum strength of 5,25 kg/cm^2.	Used for insulated wall pairs and does not withstand loads.

(Sumber : ASTM C270)

For brick wall installation, mortar used is generally mortar that is manually processed or called conventional mortar. Mortar types formed conventionally have not been able to meet all the needs of the field and the desired requirements so that modifications and innovations must be made both in terms of material aspects, the proportion of mixed engineering implementation and so on. Kinds of mortar mortar test are: the crash test, testing of mortar that has been hard, namely the compressive test, tensile strength and adhesion (Tjokrodimuljo, 2007; 79-84).

Based on SNI 2837-2008, both mixtures and material requirements are used for plastering in accordance with technical specifications and according to requirements, namely 1: 3, 1: 4, and 1: 5. This is the basis for making mortar in this study using a new type of mixing material with better technical properties is an indication of the success of the technology that can be applied as an effort to improve construction quality and cost efficiency. Increasingly complex demands for needs also need to be responded to wisely and make expectations and opportunities in business development. Mortar ready to use (Instant Mortar) is one of the products that are increasingly needed in the construction industry for several reasons such as material source, project location, product quality, management and price factors. The increasing scale of the city and the difficulty of getting quality materials at low prices and increasingly complex handling would be enough to make an excuse in developing a more practical product with better quality assurance. (Lasino, L., & Rachman, D. (2012)).

Mortar ready to use (Instant Mortar is a mixture of cement, silica sand, additives) and several other materials that can be mixed into one. Cement mortar is highly recommended for the needs of the construction of residential homes, because it has many advantages that are produced in factories so that the quality and quantity can be trusted when compared to manufacturing in the field, easy, just add water, the existence of adding additives to the mortar can overcome the occurrence of the floor lifted, cracked / cracked walls, etc. Some instant mortar products that have been issued by PT. Green Mighty Rapi which has been widely found in the market that is Rapi Mortar is one brand of instant mortar products whose products are quite complete. One of the products we will test for the compressive strength of masonry walls is the neat Instant Neat RM-115 function for the installation of brick and plaster walls.

Construction Materials for Red Brick Walls

a. Semen

Semen Portland didefinisikan sebagai semen hidrolis yang dihasilkan dengan cara menggiling terak semen portland terutama yang terdiri atas kalsium silikat yang bersifat hidrolis dan digiling bersama-sama dengan bahan tambahan berupa satu atau lebih bentuk Kristal senyawa kalsium sulfat dan boleh ditambah dengan bahan tambahan lain (SNI 15-2049-2004).

b. Sand

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According to the Decree of SNI T-15-1990-03, sand roughness is divided into 4 (four) zone gradation groups adopted from the British Standard used in Indonesia today, namely: fine sand, rather fine, rather rough. These four gradations are usually referred to as zone I (coarse sand), zone II (coarse sand), zone III (coarse sand) and zone IV (fine sand).

c. Water

In general it is known that the higher the value of the cement water factor (FAS), the lower the strength quality of concrete. However, a lower FAS value does not always mean that the strength of the concrete is higher. A lower FAS value causes difficulties in the workmanship, namely difficulties in carrying out compaction which will ultimately cause the concrete quality to decrease. Generally the value of FAS is given between 0.4 - 0.65 (Mulyono, 2004).

d. Additives (addictive)

Additives such as coloring agents, forming agents, air bubbles, accelerating or slowing down the reaction, water repellent, and other additives should not be added to the mortar unless specified conditions. If in the contract document the calcium chloride compound is clearly stated, it can be used as a hardening accelerator with a maximum amount of 2% calculated on the weight of Portland Semem grade or 1% on the weight of paired cement or a percentage of both in the mortar concerned. If it is permissible to use calcium chloride, its use must be carried out with caution, because these compounds can damage metals and some of the wall covering material. General, D. P. (2002).

Kuat Tekan Mortar

Mortar compressive strength is often used as a basic criterion for the distribution of mortar types, because measuring compressive strength of mortars is easier and can usually be directly connected to other mortar capabilities such as tensile strength and absorption capacity of mortars (ASTM C 270). Mortar compressive strength is carried out by mortar specimens with dimensions of 5x5x5 em as many as 5 test specimens.
According to SNI 03-6825-2002, in the test of compressive strength of mortar the test object is cuboid in the size of 5 cm. The compressive strength value is obtained by dividing the maximum load weight (N) by the viewing area (mm²). The equation used in determining the compressive strength value of mortar (σ) can be
seen in Equation 3.

$$\sigma = (P \max)/A \quad \ldots\ldots\ldots (2)$$

Where, Pmax, maximum compressive force, and A, cross-sectional area.
Mortar testing was carried out using cube-shaped mortar with 50 mm with a ratio of 1: 4 cement and sand mixture and Instant Neat Mortar. Testing the compressive strength of mortar can be seen in Figure 2.3.

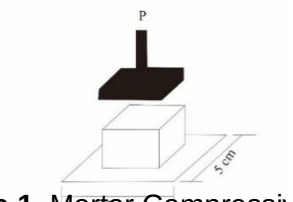

Figure 1. Mortar Compressive Strength Test
(Source : ASTM C 270)

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RESEARCH METHODOLOGY

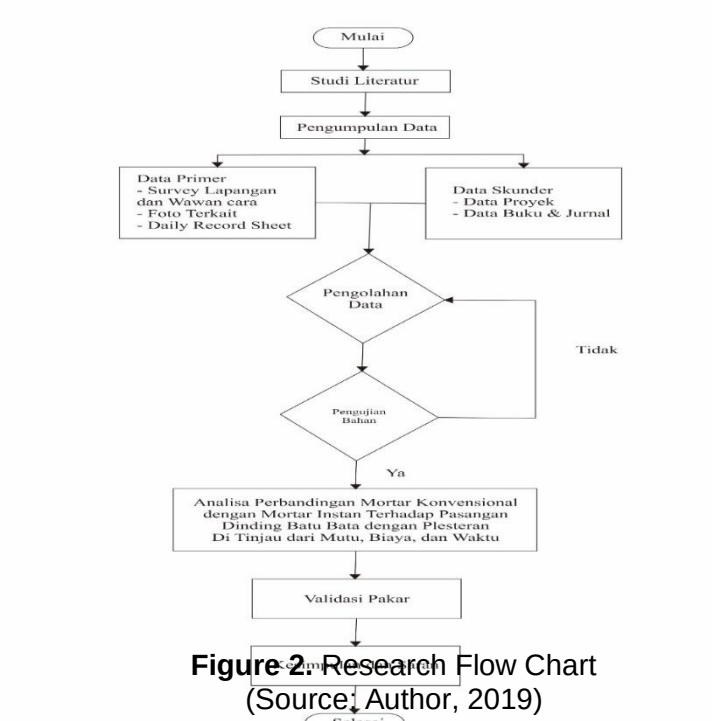

Figure 2. Research Flow Chart
(Source: Author, 2019)

The method used in this research is data retrieval with the testing process carried out in the laboratory. The purpose of this stage is to obtain data carried out at the research method stage. The data used in this study are primary data and secondary data, including :

a Primary Data
- Field surveys and interviews.
- Photos related to the tool used for testing.
- Daily record sheet

b Secondary Data
- Project data
- Books and journals

Data Processing

After all the data needed in the research has been obtained, the next step is to make the modeling that the author wants. The manufacture of test specimens will be carried out in the laboratory.

Research variable

a) The independent variable (independent variable), the variable whose changes are free is determined by the researcher. In this study the independent variable is the composition of the conventional Mortar mixture used 1: 1: 5 which will be compared with the Neat Instant Mortar production from PT. Ambassador of Mighty Facilities.

b) Dependent variable (dependent variable), the variable whose change depends on changes in the independent variable. In this research, the dependent variable is the compressive strength of mortar.

Material Testing

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a. Test Press Test Objects

Namely testing the strength of Neat Instant Mortar on the brick wall pair material, and Conventional Mortar compressive strength of red brick obtained from the laboratory of PT. Ambassador Sarana Perkasa which will be carried out by researchers. Mortar compressive strength test Mortar specimens made with dimensions of 5x5x5 em (+1.5 mm-3mm) of at least 3 pieces, with an aggregate of 1.6 to 10 mm, Align the compressed objects and the stand before testing, Tests carried out at 3, 7 , 28 days, and If there is an average difference of greater than 15%, the test must be repeated.

RESULTS AND DISCUSSION

Material Testing

1) The working steps of making mortar
a. Mortar Composition
- To determine the composition of the instant RM-115 neat mortar in this study using a volume ratio of 1: 5 using a 200 ml measuring cup, to make 9 samples needed, namely:
1) Prepare 2.09 kg of instant mortar.
2) Prepare 417.15 ml of water.
3) Mix evenly the mortar mixture in the container using a mixer.
4) Stir the mortar for 420 seconds
5) Mortar is ready to be printed, pour into the cube 50 cm x 50 mm x 50 mm until it is evenly distributed.
- As for the conventional mortar composition in this study using a ratio of 1: 5 volume to make 9 samples needed, namely:
1) Prepare 0.55 kg of holcim cement
2) Prepare 2.35 kg of white sand
3) Prepare 209.25 ml of water
4) Mix evenly the mortar mixture in the container using a mixer.
5) Stir the mortar for 420 seconds
6) Mortar is ready to be printed, pour into the cube 50 cm x 50 mm x 50 mm until it is evenly distributed.

Figure 4.1 The material is weighed first to adjust the composition
(Source: Author, 2020)

b. Mortar Print
After the mortar mixture is ready, the next step is to print the mortar with a 50 x 50 x 50 mm mortar mold.
1) Prepare the mortar that is ready to be printed.
2) Put the mortar into the mold until it is flat on the surface.
3) Let stand for 1 x 24 hours until the mortar mixture dries.
4) When the mortar has dried, give a date (according to the date of manufacture).

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Figure 3. Mortar Enter into the mold
(Source: Author, 2020)

Figure 4. Mortar given date of manufacture
(Source: Author, 2020)

b. Mortar Immersion Process
1) Put all the test items into the soaking tub.
2) At this stage the test specimen is treated (curing), by immersion in water. Wait until the age of the test object matches the test, (the age of the test being tested is 3 days, 7 days and 28 days).
1) The test work step
a. Drying and weighing processes
1) Lift the test object (age 3 days) from the soaking tub, wait until it is completely dry.
2) Then weigh the test specimen..

Figure 5. Weigh after soaking the age of 3 days
(Source: Author, 2020)

a. Compressive strength testing
1) After making and maintaining the test specimen, the compressive strength test is then performed.
2) Compressive strength testing is done after the specimen reaches the age of 3 days, 7 days and 28 days from the time of mixing.
3) For each age 3 specimens are made, so in total there are 9 specimens which will be tested for compressive strength.

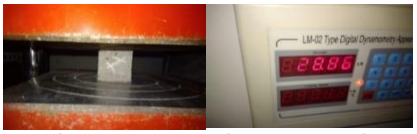

Figure 6. The compressive strength testing process
(Source: Author, 2020))

Table 3. Test Results of Mortar Compressive Strength Day 3, 7, 28

No	Matrial Mortar Material	Compressive Strength (kg / cm^2)		
		3 hr	7 hr	28 hr
1	Conventional	118,18	116,49	151,76
2	RM-115	100,96	105,4	215,88

(Sumber : Penulis, 2020)

Work productivity

a. Measurement of Work Productivity

During the work, the amount of achievement must be recorded so that it can be compared with the initial plan as an effort to evaluate the amount of productivity that has

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been achieved. Monitoring (monitoring) means conducting observations and testing at each specific interval to check the performance and unexpected side effects (Istimawan, 1996: 423 in Mohamad Harun's research).
In general, productivity can be interpreted as a comparison between output and input. Productivity is expressed by Formulas (Thomas, 1999 in Sentosa Limanto's research, 2011)..

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

As for the measurement of worker productivity, what is used is :

$$\text{Worker Productivity } (m^2/\text{jam}) = \frac{\text{Work Results } (m^2)}{\text{Hours / Duration of work}}$$

b. Productivity Measurement Method

The method used in measuring the productivity of wall mounting is the Baseline Productivity method and from the field work report or Daily record sheet.

c. Baseline Productivity

Standard productivity values can occur when there is no or only minimal disturbance in the field. This productivity value is the baseline productivity. The productivity baseline shows the standard productivity values targeted by the contractor in part of a project (Thomas, 2000). Baseline productivity is an optimal productivity condition that can be achieved.

d. Daily Record Sheet

Daily record sheet is daily productivity. The volume of work produced on that day divided by work time is formulated as follows :

$$\text{Dily Productivity} = \frac{\text{Daily Quantity}}{\text{Daily Work Hours}} \text{ x } 8 \text{ hour}$$

Observation Result of Stone Wall Installation

- Brick Wall Installation Using Conventional Mortar

Table 4. Observation Results of Installing Bricks With Conventional Mortar Materials Using the Daily Record Sheet Method

Activity	Day	Large (m^2)	Produktivitas (m^2/jam)	Time (jam/m^2)	The worker	
					Handyman 1	Handyman 2
Installation Brick	1	10,00	1,25	0,1000	1	1
	2	10,20	1,275	0,0980	1	1
	3	9,80	1,26	0,1020	1	1
Average		10,00	1,26	0,10		

(Source: Researcher's Processed Data, 2020)

Table 5. Results of Observation of Plastering Bricks With Conventional Mortar Materials Using the Daily Record Sheet Method

Activity	Day	Large (m^2)	Produktivitas (m^2/jam)	Time (jam/m^2)	The worker	
					Handyman 1	Handyman 2
Plastering	1	10,40	1,30	0,0962	1	1
	2	10,56	1,32	0,0947	1	1
	3	10,10	1,26	0,0990	1	1
Average		10,35	1,29	0,0966		

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(Source: Researcher's Processed Data, 2020)

- Pemasangan Dinding Batu Bata Menggunakan Mortar Instan RM-115

Table 6. Observation Results of Installing Bricks With Instant Mortar Material RM-115 Using the Daily Record Sheet Method

Activity	Day	Large (m^2)	Produktivitas (m^2/jam)	Time (jam/m^2)	The worker	
					Handyman 1	Handyman 2
Installation Brick	1	10,53	1,32	0,0949	1	1
	2	10,30	1,29	0,0971	1	1
	3	10,83	1,35	0,0924	1	1
Average		10,55	1,32	0,0948		

(Source: Researcher's Processed Data, 2020)

Table 7. Results of Observation of Plastering Bricks With Instant Mortar Material RM-115 Using the Daily Record Sheet Method

Activity	Day	Large (m^2)	Produktivitas (m^2/jam)	Time (jam/m^2)	The worker	
					Handyman 1	Handyman 2
Plesteran	1	10,70	1,34	0,09346	1	1
	2	10,38	1,30	0,09634	1	1
	3	11,13	1,39	0,08989	1	1
Average		10,74	1,34	0,09323		

(Source: Researcher's Processed Data, 2020)

Analysis of Brick Wall Installation Costs

The calculation of the volume of each job is adjusted to a predetermined working image to obtain results that are close to reality. For residential buildings the work volume calculation is calculated in accordance with the specified dimensions and specifications. The volume is calculated as shown in Figure 4.24 below.

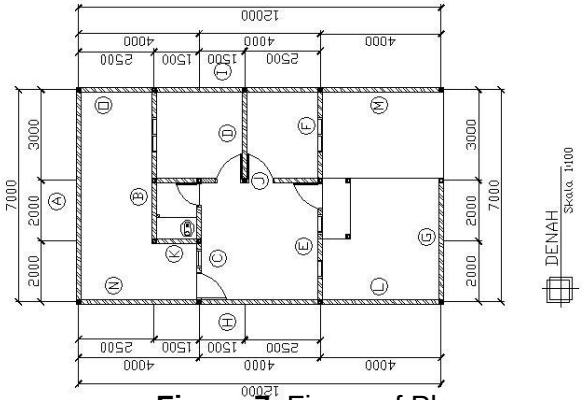

Figure 7. Figure of Plan
(Source: Author, 2020)

The volume of wall pairs obtained from drawings asbuild drawings and shop drawings where the total wall area is calculated using a simple formula length multiplied by the width and subtracted by subtracting components in the wall such as columns, beams, loops, doors, windows etc. The results of the volume calculation are as follows:

- Total Wall Length

High 3,33 m^2 = B + C + D + E + F + H + I + J + K
= 5 + 4 + 3 + 4 + 3 + 4 + 5,5 + 5,5 + 1,5 = 35,5 m^2

High 1,2 m^2 = G + M + L
= 4 + 4 + 4 = 12 m^2

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High 2,5 m^2 = A + N + O
= 7 + 4 + 2,5 = 13,5 m^2

- Overall Wall Area

High 3,33 m^2 = 3,33 x 35,5 = 118,215 m^2
High 1,2 m^2 = 1,2 x 12 = 14,4 m^2
High 2,5 m^2 = 2,5 x 13,5 = 33 m^2
Total Overall Wall Area= 118,215 + 14,4 + 33,75 = 166,365 m^2

- Area of Doors and Windows

Living room door, front room door, back room door, kitchen door
= 2,1 x 0,9 x 4 = 7,56 m^2
Door k. bath = 2,1 x 0,8 = 1,68 m^2
Living room window and kitchen window
= 1,6 x 0,6 x 3 = 2,88 m^2
Bedroom window = 1,6 x 1,115 = 1,784 m^2
Total Area of Doors and Windows = 7,56 + 1,68 + 2,88 + 1,784 = 13,904 m^2

- Overall Wall Volume

Wall volume = Overall wall area - area of window door
= 166,365 – 13,904 = 152,461 m^2

Unit prices for materials really need to be known. This is used as a reference for estimating the total building price. Material prices are obtained from survey results on the market which are then collected in a list called a unit price list of materials. The price of materials used is 2020 in Jakarta, according to the project location.

The unit price analysis data is obtained from the calculation itself by the researcher and SNI for wall work. The price is in accordance with the price of materials and labor provisions in the area of PU Prambanan, so for the draft budget the cost is obtained from the price analysis of the unit price multiplied by the volume of the wall pair. Calculation of the amount of costs required for materials and wages, as well as other costs associated with implementing the building or project.

RAB = Σ (Volume) x Unit Price of Work

After calculating the material needs, labor and unit price of material / wage, the price for each work of the wall will be obtained.

Price of Brick and Plastering Wall Installation Using Conventional Mortar Materials

- Direct Cost

1. Work on the Installation and Plastering of Brick Wall Using Conventional Mortar Materials as follows:

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Table 8. Data on Wall Installation Costs Using Conventional Cement

No	Job description	Koefisien	Unit	Unit price Material / Wages / Equipment	Total price Material / Wages / Equipment
I	**1 m² Conventional Wall Mounting Work**				
	A. Material				
	Brick	70	Buah	Rp 750,00	Rp 52.500,00
	Semen Holcim	9,68	Kg	Rp 1.075,00	Rp 10.406,00
	White Sand Bangka	0,045	m³	Rp 350.000,00	Rp 15.750,00
	Amount A				**Rp 78.656,00**
	B. Power				
	Knek (Worker)	0,3	OH	Rp 70.000,00	Rp 21.000,00
	Laden (Mason)	0,1	OH	Rp 85.000,00	Rp 8.500,00
	Head Repairman	0,01	OH	Rp 90.000,00	Rp 900,00
	Foreman	0,015	OH	Rp 90.000,00	Rp 1.350,00
	Amount B				**Rp 31.750,00**
	C. Tools needed				
	Hoe	0,013	set	Rp 47.000,00	Rp 616,55
	Bucket	0,039	set	Rp 3.000,00	Rp 118,06
	Roskam Kayu	0,013	set	Rp 27.000,00	Rp 354,19
	Spoon Specs	0,013	set	Rp 10.000,00	Rp 131,18
	Hammer	0,013	set	Rp 27.000,00	Rp 354,19
	Yarn	0,007	roll	Rp 3.500,00	Rp 22,96
	5 cm concrete nails	0,007	kg	Rp 38.000,00	Rp 249,24
	meter 50 m	0,007	set	Rp 50.000,00	Rp 327,95
	sekop	0,013	set	Rp 75.000,00	Rp 983,86
	pliers combination of 4.5 inch	0,026	set	Rp 29.700,00	Rp 779,22
	Amount C				**Rp 3.937,40**
	Amount A+B+C				**Rp 114.343,40**
	Overhead & profit : 15% x (A+B+C)				**Rp 17.151,51**
	Unit Price Installation: (A + B + C) + ((Overhead 15%)				**Rp 131.494,91**

(Source: SNI 2837: 2008, Point 6.5 and SNI 6897: 2008, Point 6.10)

Table 9. Data on Wall Plastering Costs Using Conventional Cement

No	Job description	Koefisien	Unit	Unit price Material / Wages / Equipment	Total price Material / Wages / Equipment
II	**1 m² Plastering Work**				
	A. Material				
	Semen Holcim	5,184	Kg	Rp 1.075,00	Rp 5.572,80
	White Sand Bangka	0,026	m³	Rp 350.000,00	Rp 9.100,00
	Amount A				**Rp 14.672,80**
	B. Power				
	Knek (Worker)	0,3	OH	Rp 70.000,00	Rp 21.000,00
	Laden (Mason)	0,15	OH	Rp 85.000,00	Rp 12.750,00
	Head Repairman	0,015	OH	Rp 90.000,00	Rp 1.350,00
	Foreman	0,015	OH	Rp 90.000,00	Rp 1.350,00
	Amount B				**Rp 36.450,00**
	C. Tools needed				
	Cangkul	0,013	set	Rp 47.000,00	Rp 616,55
	Ember	0,039	set	Rp 3.000,00	Rp 118,06
	Roskam Kayu	0,013	set	Rp 27.000,00	Rp 354,19
	Sendok Spesi	0,013	set	Rp 10.000,00	Rp 131,18
	Palu	0,013	set	Rp 27.000,00	Rp 354,19
	Benang	0,007	roll	Rp 3.500,00	Rp 22,96
	Paku beton 5 cm	0,007	kg	Rp 38.000,00	Rp 249,24
	Jidar kayu kaso 4 x 6	0,026	m³	Rp 28.000,00	Rp 734,61
	meteran 50 m	0,007	set	Rp 50.000,00	Rp 327,95
	shovel	0,013	set	Rp 75.000,00	Rp 983,86
	pliers combination of 4.5 inch	0,026	set	Rp 29.700,00	Rp 779,22
	Amount C				**Rp 4.672,01**
	Amount A+B+C				**Rp 55.794,81**
	Overhead & profit : 15% x (A+B+C)				**Rp 8.369,22**
	Unit Price Plastering: (A + B + C) + ((Overhead 15%)				**Rp 64.164,04**

(Source: SNI 2837: 2008, Point 6.5 and SNI 6897: 2008, Point 6.10)

Unit prices for masonry and plaster work use conventional mortar materials with the sum as follows:

Red brick pair ½ brick + Plastering Work

Rp. 131,494.91 + Rp. 64,164.04 = Rp. 195,658.95

For the overall wall volume of 152,461 m^2, the cost of carrying out the brickwork is as follows:

Total cost = brick wall installation + plaster work

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= (152,461 m^2 x Rp. 131,494.91) + (152,461 m^2 x Rp. 64,164.04)
= Rp. 29,830,358.73

2. Total Time of Brick Wall Work Using Conventional Mortar Materials

Table 9. Calculation of the Total Time of Installation of Project Work Walls Using Conventional Mortar Materials

No	Observation Type	Produktivitas (m^2/8 jam)	Wall Area (m^2)	Days
1	Installing Bricks	10,000	152,461	8
2	Plastering	10,353	152,461	7

(Source: Researcher Processed Data, 2020)

From table 4.9 it can be seen that the productivity needed to complete all conventional brick wall work on each type of observation is: installation: 10/8 = 1.26 m^2 / hour, and plastering: 10.353 / 8 = 1.29 m^2 / hour.Indrect Cost

Table 10. Work of Plastering and Plastering Walls Using Conventional Mortar Materials

No	Position	Amount	Salary	Duration of Work	Total Biaya
1	Project Manager	1	22.000.000	16 days	1.467.400
2	Engineering Team	1	6.000.000	16 days	400.200
3	Supervisor	1	5.500.000	16 days	366.850
4	Commercial	1	7.000.000	16 days	466.900
5	Finance	1	6.000.000	16 days	400.200
TOTAL					2.701.350

DESKRIPSI		PRICE
Direct Cost	Rp	29.830.358,73
Indirect Cost	Rp	2.701.350
SPF	Rp	975.951,26
Margin 10%	Rp	3.350.766,00
TOTAL	**Rp**	**36.858.425,99**

(Source: Author, 2020)

Price of Plastering and Plastering Walls Using Instant Mortar Materials RM-115

- Direct Cost

1. Work on the Installation of Bricks and Plastering Walls Using Instant Mortar Materials RM-115 as follows :

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Table 11. Data on Wall Mounting Costs Using Neat Cement RM-115

No	Job description	Koefisien	Unit	Unit price Material / Wages / Equipment		Total price Material / Wages / Equipment	
I	**1 m² Conventional Wall Mounting Work**						
	A. Material						
	Brick	70	Fruit	Rp	750,00	Rp	52.500,00
	Semen Rapi RM-115	33,3	Kg	Rp	1.750,00	Rp	58.275,00
	Amount A					**Rp**	**110.775,00**
	B. Power						
	Knek (Worker)	0,3	OH	Rp	70.000,00	Rp	21.000,00
	Laden (Mason)	0,1	OH	Rp	85.000,00	Rp	8.500,00
	Head Repairman	0,01	OH	Rp	90.000,00	Rp	900,00
	Foreman	0,015	OH	Rp	90.000,00	Rp	1.350,00
	Amount B					**Rp**	**31.750,00**
	C. Tools needed						
	Hoe	0,013	set	Rp	47.000,00	Rp	616,55
	Bucket	0,039	set	Rp	3.000,00	Rp	118,06
	Roskam Kayu	0,013	set	Rp	27.000,00	Rp	354,19
	Spoon Specs	0,013	set	Rp	10.000,00	Rp	131,18
	Hammer	0,013	set	Rp	27.000,00	Rp	354,19
	Yarn	0,007	roll	Rp	3.500,00	Rp	22,96
	5 cm concrete nails	0,007	kg	Rp	38.000,00	Rp	249,24
	meter 50 m	0,007	set	Rp	50.000,00	Rp	327,95
	sekop	0,013	set	Rp	75.000,00	Rp	983,86
	pliers combination of 4.5 inch	0,026	set	Rp	29.700,00	Rp	779,22
	Amount C					**Rp**	**3.937,40**
	Amount A+B+C					**Rp**	**146.462,40**
	Overhead & profit : 15% x (A+B+C)					**Rp**	**21.969,36**
	Unit Price Installation: (A + B + C) + ((Overhead 15%)					**Rp**	**168.431,76**

(Source: SNI 2837: 2008, Point 6.5 and SNI 6897: 2008, Point 6.10)

Table 12. Plaster Wall Cost Data Using Cement RM-115

No	Job description	Koefisien	Unit	Unit price Material / Wages / Equipment		Total price Material / Wages / Equipment	
II	**1 m² Plastering Work**						
	A. Material						
	Semen Rapi RM-115	20	Kg	Rp	1.750,00	Rp	35.000,00
	Amount A					**Rp**	**35.000,00**
	B. Power						
	Knek (Worker)	0,3	OH	Rp	70.000,00	Rp	21.000,00
	Laden (Mason)	0,15	OH	Rp	85.000,00	Rp	12.750,00
	Head Repairman	0,015	OH	Rp	90.000,00	Rp	1.350,00
	Foreman	0,015	OH	Rp	90.000,00	Rp	1.350,00
	Amount B					**Rp**	**36.450,00**
	C. Tools needed						
	Cangkul	0,013	set	Rp	47.000,00	Rp	616,55
	Ember	0,039	set	Rp	3.000,00	Rp	118,06
	Roskam Kayu	0,013	set	Rp	27.000,00	Rp	354,19
	Sendok Spesi	0,013	set	Rp	10.000,00	Rp	131,18
	Palu	0,013	set	Rp	27.000,00	Rp	354,19
	Benang	0,007	roll	Rp	3.500,00	Rp	22,96
	Paku beton 5 cm	0,007	kg	Rp	38.000,00	Rp	249,24
	Jidar kayu kaso 4 x 6	0,026	m³	Rp	28.000,00	Rp	734,61
	meteran 50 m	0,007	roll	Rp	50.000,00	Rp	327,95
	shovel	0,013	set	Rp	75.000,00	Rp	983,86
	pliers combination of 4.5 inch	0,026	set	Rp	29.700,00	Rp	779,22
	Amount C					**Rp**	**4.672,01**
	Amount A+B+C					**Rp**	**76.122,01**
	Overhead & profit : 15% x (A+B+C)					**Rp**	**11.418,30**
	Unit Price Plastering: (A + B + C) + ((Overhead 15%)					**Rp**	**87.540,32**

(Source: SNI 2837: 2008, Point 6.5 and SNI 6897: 2008, Point 6.10)

Unit prices for masonry and plaster work using mortar materials RM-115 with the sum as follows:

Red brick pair ½ brick + Plastering Work

Rp. 168,431.76 + Rp. 87,540.32 = Rp. 255,972.08

For the overall wall volume of 152,461 m^2, the cost of carrying out the brickwork is as follows:

Total cost = brick wall installation + plaster work
= (152,461 m^2 x Rp. 168,431.76) + (152,461 m^2 x Rp. 87,540.32)
= Rp. 39,025,758.85

2. Total time work of batu bata use ingredients Instan Mortar RM-115

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Table 13. Calculation of Total Time of Installation of Project Work Walls Using Instant Mortar Material RM-115

No	Observation Type	Produktivitas (m^2/8 jam)	Wall Area (m^2)	Days
1	Installing Bricks	10,553	152,461	7
2	Plastering	10,735	152,461	7

(Sumber : Data Olahan Peneliti, 2020)

From table 4.10 it can be seen that the productivity needed to complete all conventional brick wall work on each type of observation is: installation: 10.55 / 8 = 1.32 m^2 / hour, and plastering: 10.74 / 8 = 1.34 m^2 /hour.

- Indrect Cost

Table 14. Brick and Plastering Installation Work Using Mortar Materials RM-115

No	Position	Amount	Salary	Duration of Work	Total Biaya
1	Project Manager	1	22.000.000	15 days	1.467.400
2	Engineering Team	1	6.000.000	15 days	375.000
3	Supervisor	1	5.500.000	15 days	343.750
4	Commercial	1	7.000.000	15 days	437.500
5	Finance	1	6.000.000	15 days	375.000
TOTAL					2.623.650

DESKRIPSI		PRICE
Direct Cost	Rp	39.025.758,85
Indirect Cost	Rp	2.623.650
SPF	Rp	1.249.482,27
Margin 10%	Rp	4.289.889,11
TOTAL	**Rp**	**47.188.780,22**

(Sumber : Data Olahan Peneliti, 2020)

3. Analysis Results of a Comparison of Quality, Cost, and Time of Conventional Mortar and Instant Mortar

Table 15. Comparison of Quality of Cost and Time of Wall Installation Using Mortar Materials

No.	Deskripsi	Conventional Mortar		Instant Mortar RM-115	
1	Quality		151,76		215,88
2	Cost	Rp	36.858.425,99	Rp	47.188.780,22
3	Day		15		14

(Source: Researcher Processed Data, 202

CONCLUSIONS AND RECOMMENDATIONS

1. Based on the analysis, conclusions can be drawn regarding compressive strength, productivity and cost of installing red brick walls and comparison plastering using Conventional Mortar materials with neat Instant Mortar RM-115.
2. Compressive strength testing in 28 days the compressive strength of Instant Mortar RM-115 has a compressive strength value of 215.88 kg / cm2 which is

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larger and more measurable compared to Conventional Mortar which has a value of 151.76 kg / cm2 whose implementation is sometimes less precise , Instant Mortar is more durable than Conventional Mortar.

2. The time needed to complete the work of red brick wall plaster and stucco using RM-115 Instant Mortar material is 14 days, while the time required for the work of red brick wall plaster and plastering using Conventional Mortar material is 15 days. So that the work of red brick and plastering wall pairs using Instant Mortar materials RM-115 is more efficient 1 day and cleaner storage compared to using conventional Mortar materials.
3. The price of installing red brick walls and stucco using RM-115 Mortar materials in Bintaro Sector 7 housing is Rp. 36,858,425.99. While the price of installing red brick walls and plaster using conventional Mortar materials in Bintaro Sector 7 housing is Rp. 47,188,780.22. Work Installation of red brick walls and plaster using Mortar materials RM-115 is more expensive with a difference of Rp. 10,330,354.23.

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